"A Study of the Current State of Information Resource Management and End-User Computing, and Their Relative Impact on Each Other."

An Honors Thesis (Honors 499)

by

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Table of Contents

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Introduction:

Information Resource Management and End-User Computing are two areas within information systems that are currently generating a great deal of interest. These are two of the most topical areas in information systems and, as such, have not been thoroughly researched to date. Information systems are changing rapidly, and to be better equipped to use them efficiently, we need understand their relative impact and associated importance within the multitude of organizations currently using them.

A major problem is that most individuals have an diverse view of information resource management and end-user computing. Information Resource Management is a fairly new concept which is evolving in the systems area. This actually involves managers recognizing information as not only a valuable resource of the firm, but the one resource needed for decision making involving all other resources. Therefore, information becomes the most valuable resource a firm owns. Information Resource Management is the planning, directing and controlling of the information resource, as opposed to information systems management which is concerned primarily with the transportation of the resource. This brings up the initial question of our study: How important is information considered as a resource to the firm and what value can the firm place on information?

There are many questions that evolve when trying to come up with the definition of end-users. Our current working definition is that everyone who is connected to the

firm is an end-user. This definition sounds relatively simple but for many is revolutionary and hard to accept. Most information system managers in the past have seen the middle manager as the most important or only important user of a system. Our definition includes staff employees, administrators, supervisors, middle management and even customers. The second question our research will answer is: Which people encompass the end-users and how important are they within the system?

The final question and the possibly the most important part of our study is to demonstrate that Information Resource Management impacts the end-user and that end-users also impacts the information resource. This concept is ground breaking and one that is vital to our field. Through this study it is believed that we can produce information that will help information dependent companies to see the importance of these two concepts and how they are interdependent on each other.

It is felt that this project will assist information systems professionals to gain a better understanding of what the end-users are and how information can be managed as a resource. We will not only be aiding ourselves, but we will be aiding Information Specialists that are asking the questions: Who are my end-users? How can I manage my information resource effectively? What direction should our planning take?

This study should be able to help many Information Managers. We can give them some current definitions and help them with their definitions. As technology becomes more available, more people become end-users. As there are more end-users, information becomes harder to manage. If we can give Information Managers some concrete definitions, and add some structure where there previously was none,

some concrete definitions, and add some structure where there previously was none, then their jobs may be made just a little bit easier.

Procedures and Methodology:

Since this research involved exploratory data collection, the procedure used employed survey methods. The initial literature reviews did not reveal sufficient information to warrant the use of any hypothesis testing or other inferential techniques. As the study attempted to define the direction of two emerging concepts in information systems, and the relative level that these concepts are being applied survey research is the only reasonable approach to help establish a body of knowledge.

The project was broken into three separate segments; the first was a study of information resource management, the second end user computing, and the third looked at the impact of the two areas on each other. The paper is presented in that order with the findings of the survey included in the text of the discussion of each respective section.

To gather the information presented in the body of this paper, a survey instrument dealing with the three sections was developed (See Appendix). This instrument was developed specifically for this study. The questions were designed to elicit information relative to the three areas of the study as they were viewed by information managers of the firms that responded. The instrument was designed to measure the respondents' attitudes toward emerging concepts in information systems and the integration of those concepts. To do this, Likert type scales were employed. The instrument also provided for open ended responses to collect any additional comments that the respondents might have wished to give. The questionnaire was given to a panel of experts in the field to determine the internal and construct validity of

the instrument and it was piloted at two locations for reliability testing. These experts opinions were used to create the final questionnaire. Thus, the data used in this study were collected in primary fashion from a mailed questionnaire.

To encompass a broad spectrum of United States businesses, the surveys were mailed to a random sample of corporations selected from the Fortune 500 firms, the transportation industry, banking and financial firms, and the insurance industry. 300 questionnaires were mailed with pre-stamped self addressed return envelopes. From this mailing, there were 52 usable forms returned. While this return rate, about 16%, is not very high, it was felt that the total sample size was sufficiently large enough to complete this study.

Since this was exploratory research, the data received were analyzed using descriptive techniques. Frequencies and percentages were computed from the responses given on the instruments. Cross-tabulation of certain selected items were also computed. Some descriptive statistics were employed where deemed correct, if their use provided additional insight to the responses. The instrument also included some open ended questions that provided additional narrative. The data were analyzed using the facilities of the University Computing Services. The data were coded and transferred into computer acceptable form. The SPSS (Statistical Package for the Social Sciences) statistical package was used to generate the frequencies, crosstabs, and the descriptive statistics.

Information Resource Management:

Information has become a critical resource to all organizations. Most people would agree that an organization could not survive without information. I would argue that an organization cannot survive with too much unmanaged information. Information overload has. caused many organizations to evaluate and consider their information as an asset. Technological advances has made information more accessible to organizations and those within the organizations. "Technological developments, which are concrete and often times very visible from reports in the media and sales campaigns, are in sharp contrast to the advances made in the management of informati on."[1] The technology is changing rapidly and we have the ability to provide information to almost anyone who needs it, but the management of this information has (or should have) become a major priority to organizations. Information Resource Management (IRM) is a concept that is beginning to develop as organizations become concerned with information management. IRM has been required by the Federal Government since 1980, but organizations have not embraced the concept.[2] The purpose of this paper is to identify the current state of IRM per literature review and to draw some conclusions about the current impact of IRM in organizations from a personal survey.

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1. Jim Comes & Tom Harris. "Developing and Implementing an Information Resource Management Philosophy." Unpublished Working Paper. 1991. p. 1.

2. U.S. Federal Government. "The Paperwork Reduction Act of 1980." P.L. 96-511.

Origins of IRM in Business:

The United States has had technical dominance since World War II. Business thrived and America surpassed most countries in all areas of technology and business. This long period of dominance caused America to think short-term instead of the future. America thought that they could produce anything, no matter what the quality, and everyone would buy it and be happy. America lost its motivation and became satisfied with the short-term way of living. The country that was once the leader in technology and innovation became lazy and satisfied with the current state of their development.

"While America was lulled into a false sense of security by our technical successes of World War II, foreign competitors, most notable the Japanese and Germans, developed ambitious plans and made significant investments in the future."[3] They broke America's monopoly on business by producing a quality product at a reasonable price. They knew that understanding the marketplace and the needs of the customers was the key to success.[4] "Foreign competition simply had better information about our marketplace than their U.S. counterparts."[5]

Foreign and domestic businesses had to rethink their strategies because of this new competition. Organizations began to realize that in order to compete, "they must make

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3. Milt Bryce & Tim Bryce. The IRM Revolution: Blueprint for the 21st Century. (Palm Harbor, Florida: M. Bryce & Associates, Inc. 1988) p. 12.

4. Ibid p. 12.

5. Ibid p. 12.

more effective and efficient use of information."[6] These organizations began to value information as a corporate resource. They figured out that this resource could be used to gain competitive advantage in their industries.

Organizations began to turn to the computer to help them with their information needs. The computer could process the data that organizations needed, faster and more accurate than their human counterpart. The problem is that the computer still could not satisfy the informational needs of most organizations. "Instead of decreasing the backlog of information requests, as promised, the backlog actually increased."[7] The root of this problem stems from poor management of the systems. The management of systems used to be given to the computer technicians who knew the systems but not the problems of the business. The technology became the focus, and not the business.

Organizations began to appoint a specific person to oversee the new technology because existing managers did not want to have anything to do with the new technology. The person placed over the technology was usually called the Data Processing Manager. This person was technically inclined and was given, free reign over the new technology.[8] At this point in systems development, there was no pressure put on the data processing department to solve problems. This attitude caused systems to be put together as they were needed, instead of being coordinated. This lack of coordination only allowed the systems to solve problems in the short run. In later years,

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6. Ibid p. 13.

7. Ibid p. 13.

8. Ibid p. 13.

the lack of coordination caused problems because data was not shared, documentation was nonexistent, and nothing was integrated.[9]

The end-user was left out of this whole process. The focus was on what the computer could do and what data processing could make the computer do. Executive management became dissatisfied with what data processing was giving them, so the began demanding more information that would help them with business problems. "The D. P. department began to recognize it must manage itself in order to accommodate these growing business needs. The D.P. Manager was replaced by an 'MIS Director,' someone who had more management skill and was adept at working with other corporate managers and understanding information needs."[10] This was the point where management began to realize the importance of information.

The beginnings of IRM could be seen at this point. Some management controls were placed in the area of project management and documentation.[11] There was still no organization in the methods that management applied. Solutions to problems were dealt with when they showed up. There was no overall plan or coordination in the development of systems.

The problem is that this seems to be the state of most businesses today. The technology is still the focus of most organizations, the problems of the business itself are not being addressed properly. Organizations are beginning to realizing that this

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9. Ibid p. 14.

10. Ibid p. 14.

11. Ibid p. 14.

approach to information management will not work any longer. They are realizing that information must be treated as a resource and that there must be a coordinated and organized method of managing this resource.

The Current State of Information Resource Management:

Managers are beginning to realize that in order to use information for a competitive advantage, they must have accurate and timely information. Improperly managed information will not be able to provide this type of information. Information Resource Management can help provide accurate and timely information. But what is Information Resource Management?

> IRM is fundamentally a management activity. It is applied to organizations, not to individual, national, and international levels of society. It is concerned with information assets, or the content of on, as well as with information resources, or the equipment, and people through which an organization handles its information.[12]

IRM is a concept that managers are to integrate into their organizations to help them in coordinating their information activities. "IRM addresses a major organizational concern: applying information resources to achieve strategic objectives."[13]

All managers need to be concerned with applying IRM concepts within their organizations. No manager can overlook IRM anymore. "If you are unfamiliar with the basic concepts of IRM, look into it. If you are familiar with IRM, investigate its use to

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12. Richard H. Lytle. "Information Resource Management: 1981-1986. Annual Review of Information Science and Technology. Volume 21, 1986. p. 310.

13. Ibid p. 311.

improve your control over your company's data."[14] With the mass amounts of data that are available to organizations, some amount of control over that data is needed. If there is no control over data or information, it will be of no use to an organization because they will not be able to find the information needed for decision making. Organizations that do not have some sort of IRM policies in practice, will just have mass amounts of unusable data. That data may be valid and accurate, but if it is not in a usable form, it is of no use to a manager. All organizations must be concerned with managing their information resource.

Since all organizations need to be concerned with applying IRM concepts, what areas within an organization does IRM apply to? Richard H. Lytle points out that IRM has progressed in six areas: "I) managing the content of information or information assets; 2) managing information as an integral part of the organization's strategic planning; 3) managing information through information policies; 4) measuring the cost and value of information in order too manage it; 5) managing the impact of information on organizations; and 6) managing the converging information technologies of data processing, telecommunications, and office automation."[15] Management needs to look at all of these areas and their organization and see how well they are doing. Do they manage the content of their information? Are they integrating data processing, telecommunications, and office automation? Managers need to ask these questions and

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14. "Entity Relationship Modeling." The Computer Conference Newsletter. September 10, 1990. p. 8.

15. Richard H. Lytle. "Information Resource Management: 1981-1986." Annual Review of Information Science and Technology. Volume 21, 1986. p. 311.

see if they are following the concepts of IRM and managing their information resource as an asset, or to see where their weaknesses are in these areas.

What are some of the current areas that are giving management difficulty in the areas of IRM? Some of the current issues seem to be the need for better staffing, training for information systems audit and security, and the difficulty of keeping up with technology.[16] These areas are keeping managers from having a well managed information resource. Staffing not only refers to the need for more people, but the need for qualified people. "The information-based organization requires far more specialists overall than the command-and-control companies we are accustomed to."[17] Specialists that know the needs of the business more than the technology are essential to the organization that wants to use information as a strategic weapon. The need for training these people is essential as well. They need to know what information is important and how to distribute that information to the right people. The technology is important, but it should not be the focus of the information department. The technology should be used as a tool, and updated when the current technology becomes inadequate. Once an IRM policy is adopted, there should be a change in management focus from one of managing costs and technology, to one of making investments, increasing productivity,

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16. David R. Lee. "Changing Responsibilities: For Audit and Security of Information Resources." Information Executive. Spring 1990.

17. Peter F. Drucker. "The Coming of the New Organization." Harvard Business Review. January-February 1988. p. 47.

and realizing that technology can benefit the organization if it is applied to the business objectives.[18]

The flattening of most organizations is having an impact on IRM. The slow disappearance of middle management within organizations is making it more difficult to define what information is needed by what individuals. With a hierarchial organizational structure, the data needs of individuals was easier to identify. Executives need very general data about the organization, middle managers need a little more detail than the executives, and the supervisors need very detailed information. This simple model no longer applies to most organizations. As technology has changed, so have the organizations where technology is applied. The data needs of individuals are not as easily defined. There is no set organizational structure any longer. This makes IRM difficult for Information System professionals. They cannot tell what information is needed by most individuals. An IRM plan needs to be adopted by IS departments to try an identify the information needs of individuals and the organization.

The Need for More Study in the Area of IRM:

We defined IRM and stressed that all organizations and managers need to be adopting IRM concepts. We then pointed out the areas that IRM applies to and urged managers to look at their organization to see what areas they were weakest in. We finally pointed out the current areas that are giving IS managers and organizations

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18. Thomas R. Davies. "Managing the Stages of Information Resource Management Implementation." Information Management Review. Winter 1987.

difficulty in the area of IRM. There are more questions that need to be answered that were not answered in the literature.

What organizations are applying the concepts of IRM to their business? We know that IRM is important and that all organizations need to have an IRM policy in effect. As pointed out earlier, the government requires organizations to have an IRM policy. We still do not know who is using the IRM concepts.

There are no IRM models. As mentioned earlier, organizations are flattening and information needs are changing rapidly. Currently, there are no models that can help managers define the information needs of their organizations. Further research in the area of IRM is needed in order to form a general model of the information needs of organizations. Some sort of a general IRM model is needed in order to help managers define their organization's information needs. "Before IRM as a philosophy can be successfully integrated into an organization as a functional basis for initiating information systems, a planning model must be established."[19] The final reason that more research needs to be done in the area is because there is no idea about the future of IRM within organizations. The literature either does not cover the future of IRM or it only makes predictions about the future of IRM. More research is needed to find out what IS professionals feel about the future of IRM. If some thoughts about the future can be determined, maybe managers can benefit by being able to plan for the future importance of IRM within their organizations.

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19. Jim Comes & Tom Harris. "Developing and Implementing an Information Resource Management Philosophy: A Proposed Model." Unpublished Working Paper. 1991. p. 10.

The Study on Information Resource Management:

A survey was developed and delivered to determine the current status of IRM within organizations. We developed a scenario of what we felt IRM was in today's businesses. (See Appendix) We then sent the survey to IS professionals is several types of businesses. The responses varied and we did receive enough information on the first mailing to gain some initial direction into the current status of IRM.

From the survey we found that most organizations thought that the survey described their firms somewhat to very well with most responses falling in the middle of the two. This means that most firms have taken what we would call a current view to IRM. They value information as a resource and are aware of the IRM concepts that are mentioned in the scenario. One response was as follows: "As a Fortune 100 company, we have for years worked on accuracy and integrity through audit and security functions." Another response was as follows: "We support the IRM philosophy and, as such, have established a central data security administrator to oversee the information resource." Some firms have not taken grasp of the IRM philosophy as such, but no one denied its importance. As an interesting side note, those in the financial and transportation business said that this scenario described their firms very well.

On question three, the responses were mostly the same. Most organizations said that it is the responsibility of either corporate management or information systems management or both, to implement a corporate IRM philosophy. "IRM must be a total commitment of an institution in order to be an effective guardian of the company's information." "Authority should come from executive management." Most organizations that responded realize that for an IRM philosophy to be implemented successfully

corporate wide, senior management must not only support it, but be involved as well. "Needs top down support and direction." An IRM philosophy must be integrated into the corporate way of life. Senior management has the ability to make an IRM philosophy successful within an organization. Without senior management working directly with IS management, a successful corporate wide IRM philosophy will never be implemented.

Most organizations felt that IRM will become very important in the next decade. "It will be very important in the future, especially in those sectors of business involving the retail public being the end user of services." "Superior companies will provide for superior management of their information." IRM is not going to go away. It will become more important in the next decade. Those businesses that want to remain competitive will have to manage their information resource effectively. IRM will have to become a corporate philosophy for all of the firms that to continue to be in business. The practice of IRM is somewhat a choice at this point in time, but in the next decade, organizations will have no choice.

IRM is responsible for the availability, integrity, accuracy, validity and security of data. The IRM philosophy must be integrated into the organizational philosophy. Management has the ability to successfully implement an IRM plan into an organization. It will take the full commitment of management to make the plan successful. Most organizations support the concepts of IRM and feel that it will become critical within the next decade. Any organization that values its information as a resource, will embrace the concepts of IRM and practice them.

End-User Computing:

End-user computing (EUC) is a relatively new concept that has quickly emerged over the last decade. With the increased use of the personal computer in the business environment we entered an age where the user's needs are considered a priority, compared to the days of the mainframe when the central information system department had total control and was the highest information priority.

In the early days of data processing, the '60s and '70s, the end-users had to rely on a centralized data center. The user had to take requests for information to the center, then the center would process the request and return with a printed report that might have taken days to finish. According to John Maher this report only represented one version of the truth because the data center existed on solely mainframe technology, the data center was in total control of the information management and dissipation.[20]

This brings up the question if end-user computing was driven by a demand from users who were unhappy with the traditional data processing methods, or has it been pushed by technological growth. Perhaps it is not just one of these which caused a rapid growth in end-user computing in the '80s, but a combination of these two factors which caused the growth. Boyer writes that end-user computing does overlap into traditional data processing, it is a natural means for an employee to improve performance and also gain control over the information center at the workplace. The improvement in technology and the demand by the end-user to have more control over the information has changed the way people work by allowing the user to focus on basic job responsibilities and given the potential for the user to improve productivity. Boyer does point out, although that there are risks that are involved with the emergence of EUC. These risks include security and reliability, integrity of information

[20] Maher, John. "Cross Platform Software Solutions Ease Data Centre's Load". Computing Canada. Jan 3, 1991. p 11.

and other management problems when implementing the EUC method.[21]

Now that the reasons why the EUC practice has evolved have been stated it is imperative to define who is an end-user. As Cotterman and Kulmar point out that in previous definitions the end-user was based on differing conceptualizations of the users and their interaction with the information system. Most previous studies define the end-user anywhere from those who use computers to those end-users who actually develop their own system and even those who control the development and use of the information system. Even with a range this broad different authors use different subsets to classify the users from somewhere in this range.[22]

In order to go on about end-user computing, a solid definition of who the end-user is needs to be put forth in order to avoid any ambiguity. Our definition of the end user is as follows:

* An end-user is anyone who uses or is affected by the information of the organization.

By defining the end-user this way it can encompass anyone who needs the use of information to do their jobs. This can include, but is not inclusive to, customer service, staff employees, supervisors, middle management, administration and customers of the firm. Therefore a a definition for end-user computing is formulated as follows:

* End-user computing is the activities of the end-users in order to obtain the needed information which they need for the purpose of doing their job.

[21] Boyer, Glen L. "Ten Facts of End-User Computing for Every Systems Manager." Journal of Systems Management. June 1990. v 41. p 14.

[22] Cotterman, William W. and Kumar, Kuldeep. "User Cube: a Taxonomy of End-Users." Communications of the ACM. Nov. 1989. v 32 p 1313 (8).

Current Literature in End-User Computing:

To get an idea of the current state of EUC it is important to look at the state per literature review. In the current literature on end-users there is a great variety of opinions given on who the end-user is and what the goals of EUC are, but what is consistent through most of the readings is the strong belief that end-user computing is vital to business today and that this is going to continue into the future.

Cotterman and Kumar's analysis of EUC literature found that existing definitions either confound or overlook the underlying dimensions of end-user computing. One dimension which the other authors left out of their definitions is that end-users are enjoying more control of the information system. This control is allowed by increased technical and information systems knowledge of the user, increased ability to acquire technology, greater learning, the use of new hardware and software generation and reduced cost of computers. Cotterman and Kumar attribute these factors to the users ability to control computing and development resources because now the users have the knowledge and can financially afford to obtain and use the hardware, software and development resources. This is one of the few current articles that gives a new perspective which can help to build upon the way EUC is perceived.

Another author, Kenneth Banks looks at the importance of the needs of the user. Banks expands on end-user growth in the '80s, which he calls the "networking decade", into the '90s. The '90s he refers to as the client-server computing decade. His ideas on the '90s include the marriage of mainframe and minicomputers to a network. This accomplishment of this connectivity will show how successful the growth of EUC networking in the '80s can transform to providing greater user service for this decade. Banks says the industry has matured because the drive of customer demand has pushed the computer business to become a "network systems integration business". This will protect the money already invested in personal computer

hardware and at the same time provide for the benefits of minicomputer and mainframe based systems.[23] The main point to get from Banks is in the title of his article "the client must be served." This is important because it shows that the people who use the system are clients of the IS. Whatever these people need to do increase the potential of their job needs to be addressed. Banks does an excellent job of showing the importance of the needs of the end-user, by showing the necessity of an IS department to meet the needs of all the people it serves.

A trend we are just beginning to find that coincides with the article Banks wrote about serving the user is referring to the end-user as a customer. Perry describes the similarities between customers of the organization and the customers (end-users) of the IS. Just like outside customer the end-users want a product that works and when they are having trouble getting the product to work correctly they want help to get the product work. Perry believes that the IS should set itself up to emulate the characteristics of customer service in a department store. It should set up so it can serve the entire organization. When they receive a complaint it should be noted so the frequency can be tabulated and those problems can be fixed in the future.[24] Perry does draw a good analogy between serving end-users and serving customers. Just like customer service in a department store this philosophy can help to improve relations between the IS and the users so they can work towards common goals.

Buckler concurs with Banks and Perry on the importance of meeting the needs of the end-user. He writes about the importance of hardware and software selection and how that decision should be made. Some problems in the selection of hardware and software include letting emotional and political factors influence decisions on which type of products to acquire. Buckler suggests that this influence has to be

[23] Banks, Kenneth G. "Networking 1990s style: the client must be served. Systems Integration. Oct. 1990. p 37.

[24] Perry, William E. "Recognize that 'End-Users' are Customers." Government Computer News. April 2, 1990. p 50.

reduced to make a rational decision. The first step in the process is to identify a need from the end-user. The IS department then is to set requirements for the products in consideration. These requirements include: most importantly, fitting the needs of the user, looking at the compatibility of the product in relation to the environment it will be working in, the dependability, training and support that will be required for the product. The next step is very important to the end-user because they must be involved. The user is to look over a condensed list of products and choose which ones are to be tested. The user must be involved with the testing too. Since end-user is going to have to live with the decision their input is vital to the success of the new product within the organization.[25] Buckler makes a good point in that there is not enough user involvement in systems selection and implementation in business today. The IS needs to let the end-user take some control over this process. The days where the IS is the authority which knows what is good for the users is over. The information system manager's job is to support the user, and that is the person who knows the most about what they need.

This support concept is a prevalent topic when looking at current literature on EUC. In a research model by Bergeron, Rivard and Serre, they described the one common result to nearly all previous studies is the importance of providing support to users. The authors looked at the role of support from the information center and how it relates to the user's satisfaction of the information system. The study found that there is a high degree of correlation between the different levels of support and the satisfaction of the system's users. The data they collected suggests that the closeness of the information center, the variety of services provided and the proportion of IS budget devoted to the information center are positively related with user satisfaction. The number of information center employees and databases and software tools,

[25] Buckler, Grant. "Micro Managers and the Selection Process; Depending on Organization,Buying Procedures Vary." Computing Canada. Nov. 8, 1990. p42.

although, are negatively related to user satisfaction.[26] This study confirms the importance of support from the information center. It is interesting that the users want help services from the center and they want simplicity with a small number of people and products. The users do not seem to want a lot of software and databases, instead the end-user desires to only need a few products in order to complete their jobs. It is important to remember that these few products need to be able to meet the users' needs, this is where it is a necessity for the center to provide support to the users.

The growth of end-user computing and the distribution of the IS throughout the organization has brought about an increased knowledge of what used to be solely qualifications of the information systems specialists. The increased use of personal computers has made the end-user proficient in technology and heightened ability to make their own information system decisions. This has changed the general job of the IS professionals, who used to direct their users, to a consultant type of position. McClatchy, like Buckler, Perry and Banks, agrees that the key to the future of EUC is a type of relationship where both the user and the IS staff can work together for the benefit of the organization.[27] With this increased sophistication of end-users the IS has to capitalize on their abilities and channel efforts to make the system more efficient for the users.

With the increased sophistication of the end-user it is important for the end-users to support the information systems department and organization, in addition to the information system's responsibility of supporting the end-users. In an article by Hefferon he describe the responsibilities the end-users have to the information system. Some of these responsibilities Hefferon gives are: the definition of the hardware and software required, trying, to the best of their ability to do some preliminary trouble-

[26] Bergeron, Francois; Rivard, Suzanne; Serre, Lyne De. "Investigating the Support Role of the Information Center." MIS Quarterly. Sept. 1990. p 246 (15).

[27] McClatchy, Will. "The End USer Gets Wiser; at Some Shops, MIS Now Dispenses Advice, Not Orders. Information Week. Sept. 3 1990. p 32 (2).

shooting before calling the IS department for help. The also needs to take some responsibility to adhere to standards set for data processing, use applications efficiently and take responsibility for hardware, software and data to protect it from physical and information security harm.[28] With the growth and increase in control caused by the EUC phenomenon, Hefferon makes a valid statement on the exigency of the users to help take responsibility for information system's management. It is also important for the people in charge of supporting the end-users to teach them how to take responsibility and in what areas responsibility is needed.

Now that some of the current trends in writing of end-user computing have been covered it should be clear that there are many differing views on how the subject should be studied and how important EUC is to an organization. As pointed out earlier there are many different conceptualizations of end-users in current literature, this is the reason that we need to further try to define who is an end-user in an organization and what impact the end-users have on the organization.

Why do we need to define a concept that already has been defined in many different terms? The main reason is because there is agreement about the growth of end-user computing but there is no consensus in the definition of EUC. When the various definitions of EUC are examined, there are discrepancies among them answering questions such as: who qualifies as an end-user; who is responsible for development; and who provides the facilities for EUC.[29] Our study is going to try to answer who qualifies; who takes responsibility and who provides the facilities for these users.

This study is also needed because of the rapid change in EUC in the past decades. As Maher was earlier cited the needs of end-users have changed drastically throughout the past thirty years. From mainframes, which the users wholly relied on

[28] Hefferon, George J. "A Two Way Street." Information Executive. Fall 1990. p. 27 (3).

[29] Wagner, Jennifer. "What is End-user Computing?" Information Executive. Fall 1990. p. 24 - 27.

the personnel from the data center, to today where microcomputers are accessible by almost every person in the organization who needs information to do their job. This change in user power is occurring so rapidly that the subject needs to be continuously analyzed to show how users are responding to this phenomena and how the organization's information system structure are actually changing due to this change. There has not been enough studied on the change required to meet the increased demand of the end-users. As pointed out by the study by O'Shea and Muralidhar, one of the current obstacles to end-user satisfaction is the lack of corporate strategy for end-user computing.[30] This study will help show the need of corporations to develop a strategy to keep up with the emerging trends in EUC.

It is clear that EUC is a topic that is not well defined at this stage and that with the rapid changes in EUC trends and philosophies that it is imperative that we continue to study the subject. This study will look at how corporations are responding (or failing to respond) to these end-user demands and will analyze which types of firms are prospering and failing because of their abilities to meet user demands. This is an important topic that our study will try to make clearer in answering many of the confusing questions concerning EUC.

[30] O'Shea, Kathleen; Muralidhar, Krishnamurty. "The Function and Management of Information Centers. Journal of Systems Management. Dec. 1990. p. 7 - 10.

The Study On End-User Computing:

In the end user section of our survey, as in our IRM and end user/IRM sections, the subjects were given our brief definition of end users. The definition is as follows:

> An end user in an organization is anyone who uses or is affected by the information of the organization. End users may include customer service and staff employees, supervisors, middle management, administrators and customers. End users are those who need information to do their jobs.
>
> End users have become a more important ingredient within the information system process due to the use of intelligent workstations and the realization that information is important to anyone involved in the business process.
>
> End users are not centralized within an organization but are dispersed throughout it. In addition to employees, we now have customers who interface with the business process. Customers are now End Users, too.

This brief definition was followed by five questions which the respondent could relate their firm with the definition given, with space given for those who wished to make additional comments.

The first question asked the respondent to answer to what extent is their firm committed to serving the end user. This question was answered on a Likert response scale from values one (1) to five (5). One (1) being assigned to very committed, three (3) being assigned to somewhat committed, and five (5) being assigned to not committed at all. The average answer fell at 1.549 and the most answered response was at one (1) with 64.7% responding that they were very committed to serving the end user. The lowest number answered was at three (3) with 19.6% of the people answering that they were only somewhat committed to serving their users and none

answered that they weren't interested at all in serving their end user.

The answers the respondents gave to this question supports our belief that the system's end users are important to the firm. One firm commented "the end user is 'where the action is'. Nothing happens in our company before you make one good part and ship it out the door. This causes end users to get into the action." This firm is one that believes there is great value to serving the end user. Another firm stated that their firm was very committed but more in theory than in practice, which helps to show that firms know how important the user is, but how difficult it can be to actually put the end-user philosophy into affect. One of the firms that answered three (3) one the scale commented that they were having a difficult time getting the senior management to understand the concept of serving the end user.

After we found out if the firm was committed to serving the end-user we asked who was primarily responsible for the involvement of the end user. The subject was given these choices: corporate management, divisional management, information systems management, information systems staff and a opportunity to list any others that we may not have included. Only 5.9% of the respondents answered corporate management is the primarily responsible for the end users. One who answered corporate management said their IS staff works with the corporate management to respond to the needs of the end users.

The highest percentage answered that divisional management was the one responsible for the involvement of the end user. One of the 29% who answered divisional management said that the divisional manager will give more attention to the aggressive and innovative end user then the passive one. The next highest answer at

27.5% is information systems management and over 13% of our respondents believe that the information systems staff is primarily responsible for the involvement of end users.

Many of the firms who responded, approximately 17%, gave multiple levels of management as responsible for the involvement of the end user. One responded that multiple levels of management and the users are to work together in teams for design and implementation for all new projects. Another 6% responded with other groups as being responsible for end-user involvement Among those was the end users themselves are the most responsible within this person's firm. He/she said, "End user must be self motivated and provide ideas, we provide a computing utility, a data repository, some computing analysis skills, some helpful approaches. We expect the end user to direct us relative to his/her information needs within their functional areas.

There was great difference in belief on who should be responsible for the user's involvement between the firms who responded to our questionnaire. Although many believed that the end user should take a large part of the responsibility along with management to get involved. The rest of the people who responded said that multiple levels of management are primarily responsible for involvement of the end user.

The third question asked if the person sees end users acquiring and using information as a growing phenomena in the next decade. This question was answered on a Likert response scale with one (1) meaning very much so, three (3) meaning somewhat a growing phenomena and five (5) is not a growing phenomena at all. Over 70% of those answering said that end users acquiring and using information is very much a growing phenomena. The average was 1.373, with 23.5 percent

answering at two (2) on the scale. As one person answered, "'Work smarter - not harder'. As more young people become computer literate and computer comfortable, they will come into the work force expecting to use computers and rapid and accurate information to assist them." Another believed that the ones who will acquire and use the information are those that have the wisdom to do so.

Only six percent answered that it is only a somewhat of a growing phenomena, with only one answer at four on the scale. Apparently a large share of firms believe that the end user involvement in the acquisition and use of information will increase within the next decade.

The fourth question asked how involved the end user himself/herself in the respondents corporate strategic planning process. this question was also answered on a Likert response scale from one (1) to five (5). One (1) was very involved while five (5) was not involved at all and three (3) was assigned to somewhat involved with the corporate planning process. Over 27% of those who answered believed that the end user himself/herself is very involved in the corporate strategic planning process. Almost 22% answered at two (2). One commented that if the end user's insight is encouraged it will be there and if the end user is cooperated with, the I/S staff will gain considerable insight into all company functions, which will in turn, the insights should find their way into corporate MIS plans which should be congruent with corporate strategic plans.

Thirty-six percent of those answered that the user is only be somewhat involved with the strategic corporate planning with the rest of the 14% did not involve their end-user very much with the strategic planning process. One problem noted often in

comments are that the users do not want to become involved with the planning process.

The last question asked if one class of users was more important than the others. Over 52% of the people answered that all end users were of equal importance. One commented "Classes of end users need different categories of information, all of which are very important to each and every specific end user." Another answered similarly that all needs are important and that executive management needs to be responded to quicker than others, but their needs are only a small percentage of the information needs.

The other 47% answered that one class was more important than the others. 19.2% believed that executive management was the most important user group. One commented that this is true only if information is gathered to support company goals/vision, and executive management has that vision. Twenty-three percent believe that all management is the most important end user while 11.5% and 3.8% believe that support staff and general staff respectively. One that answered general staff justified, "general staff serves the customer and clients. This is where you lose or win!"

Of the people that believed one class was more important than the others, 30.8% said that customers were the most important of the end users. A representative from a service providing company said that the customer must be considered in most IS planning. Another responded that anything that facilitates service to customer is a top priority.

Information Resource Management and End-User Computing:

The relationship of the end user to IRM is a complex one. The IRM manager must balance the needs of the user against the need to provide and adhere to corporate wide policies regulating information resources in the firm. The users' needs are often in direct conflict with the IRM manager's objectives, such as the need for access versus the need for security. The task then for information resource management is to formulate a strategy and set of guidelines that will facilitate maximum access to the firm's information resources and, concurrently, confront the responsibility of proper IRM.

If end users are to become an intelligent users, they must be aware of the principles involved in IRM. The end user must be made aware of the value of information. It is imperative that the end user knows the processes and problems involved with providing accurate and timely information in the desired form. Only then will the end user be an intelligent consumer of this resource.

To facilitate the end user's enhanced awareness, IS management must make a concerted effort to formalize, yet humanize, IRM practices within the organization. This requires much care on the part of IS management to develop a good balance of IRM policies and standards and meeting the needs of the end user. The solicitation of information needs and feedback from the end user is mandated if the IRM practices are to be successfully implemented. The information resource manager must remain flexible and adaptive in his approach to management of the information resource. Nowhere is this more apparent than in managing the human resource of the firm, the end user.

With IRM, the end users will recognize the business importance of the use of information systems and their respective jobs. Good IRM will provide a working relationship between the end users and their managers with the information systems professionals. This in turn will lead to quality programs that can increase the reliability, efficiency, integrity, usability, maintainability, testability, portability, reusability of information and the compatibility of all systems for all users.

The Study on Information Resource Management and End-User Computing:

In the end user and information resource management section of our survey, the subjects were given a brief description of how the two topics are related. This description was presented as follows:

> End users and information resource management can work together and supplement each other. With both aspects emerging quickly in information trends today they can be viewed as working together to enhance the information capabilities of a firm.
>
> End users must have the ability to impact information resource management. End users the most knowledgeable about their own information needs and therefore should have a tremendous affect on the manner in which the information resource is managed.
>
> Information Resource Management also has a large impact on the end user. IRM can improve the end users ability to process information by providing guidelines and standards that will direct proper use of the information resource. This will provide the end user with the correct information where and when they need it, in the form it is needed, while also protecting and securing the information resource.

This brief definition was followed by five questions which the respondent could relate their firm with the definition given, with space given for those who wished to make additional comments.

The first question asked if the respondent felt the end user will have a stronger impact on IRM or if they felt that IRM will affect the end user greater. This question was answered on the Likert response scale from values one (1) to five (5). One (1) being assigned to IRM most important and five (5) being assigned to end user being the most important. The mean answer was at 3.12 which puts IRM and end users at an equal level of importance with 26% of the respondent answering at 3. One person answered that IRM and end users need to be equally balanced and MIS needs to better understand the business processes and adopt standards while the end user needs to better understand technology and the need for standards.

Eight percent of the respondent answered at one (1) where IRM was more important, while 22% answered at level two (2) on the Likert scale. One respondent who answered at one (1) said, "IRM will have a stronger impact on the user because the user will be limited to only the information that he/she needs to do his/her job. One of the respondents who answered at two (2) said that "IRM will enable end users, whereas individual end users will have less impact in what information was accumulated. Another said that a proactive information resource management that believes in end user self sufficiency.

Over 37% of those who responded answered at four (4) , leaning toward the end user having a stronger impact on IRM. One answered that if the information is not critical/strategic, that it does not matter how well the information is secured or organized. Only six percent responded at five (5) on the scale saying that the end user was the full factor in shaping the information resource management.

The next question, also answered on a Likert response scale, asked if end users effectiveness can be optimized without well managed corporate information. One (1) was assigned the value that effectiveness can definitely be optimized without well managed corporate information. Three (3) was assigned the value of somewhat and five (5) was assigned to end users' effectiveness not at all being optimized without well managed corporate information.

Only two percent said that end users could maximize their effectiveness without well managed corporate information by answering at level two (2) and 18% answered at three (3) on the Likert scale. The average came in at 4.06 with just over half of the respondents saying that effectiveness can't be optimized without well managed corporate information. One person answered, "there are right and wrong ways to do things. There must be a corporate wide infrastructure to guide the way to individual creativity." 28% answered that end user effectiveness can not be optimized without the well managed corporate information.

The third question asked if the end user will shape corporate IRM policy during the next decade. This question was also answered on a Likert response scale on a scale from one (1) to five (5). One (1) is assigned the value that the end user will definitely shape corporate IRM policy during the next decade. Three (3) is assigned to the end user only being somewhat of a factor in shaping the corporate IRM policy, while five (5) corresponds to the user not shaping the policy at all.

Fourteen percent answered at one (1), believing that the end user will definitely be involved in shaping the corporate policy. One person commented that this depends on the subject to which they become knowledgeable and involved. The

mean was at 2.36, with 42% answering at the second level. One respondent commented that users share IRM by prioritizing and funding systems.

Over 37% answered that the end user will only somewhat corporate IRM policy during the next decade. One commented, "We will definitely learn from each other, if we all keep open minds. Everyone has something to offer the enterprise, MIS does not have a monopoly on IRM ideas. Only six percent believed that the end user will not have much of a roll shaping the corporate IRM policy during the next decade answering at four (4). No one answered that the end user will not shape the corporate IRM policy in the next decade.

The fourth question asked who should be responsible for directing and integrating the information resources and the end users. Eighteen percent of the respondents believe that corporate management will bear the responsibility. One person answered that IS does not understand the customer and has less drive to serve them than corporate management does.

Fourteen percent said divisional management should be responsible for directing and integrating the information resources and the end users. One person who answered this said IS has a strong "warehousing" and infrastructure role. The most people answered that information systems management was to be responsible for directing and integrating the information and resources, with over 41% answering there. One respondent commented, "MIS should as 'gadflies', acting as a constructively provocative stimulus in criticizing existing institutions and procedures. Not one person answered that the information staff should be responsible for the directing and integrating the information resources and the end users.

Over 22% answered that there are combinations of management that should be responsible for the directing and integrating of the information resources and the end users. One person answered that this depends on the strengths and knowledge of the end users because some need to be 'led', while others need to be kept in tow.

The last question asked if one class of users have a stronger impact on the information resources than others. Over 43% of the respondents answered that all classes of users have the same impact on the information resources than others. One commented that each group had something to offer and all groups needed to be listened to. Another commented that everyone needs access upon demand and one said that it depends on the type of information in different situations and different groups. The rest of the people answered that some groups are more important than others.

24% of those who answered that one section was more important than others answered that executive management was the most important. One person answered that his/her firm cannot rely on division management's judgement to make decisions for the greater benefit of the corporation. The highest percentage, 42%, said that all management has the strongest impact on information resources than others. One said that all management should have the responsibility to protect the company's information resources.

Over 21% answered that the customers have the strongest impact on information resources. One respondent answered that effectiveness and success in marketplace will be directly related to meeting customer needs. The general staff was

perceived by 3% of the people to be the most important and the others believed that more than one group has the strongest impact on IRM.

Conclusion:

Information Resource Management is definitely growing in importance. Organizations now have the ability to gather more information than they need to operate efficiently and effectively. Organizations are beginning to experience information overload. They need to organize their information and determine what is important and what is irrelevant to the organizational function. Management needs to make a conscience decision to implement Information Resource Management policies within their organizations. Information Resource Management will only become a more important concern in the years to come, and the smart managers will make sure that their organizations are prepared. Information Resource Management may well become a corporate mandate in the next decade.

End-User computing has arrived and the concept is critically important to all organizations. Organizations need to determine who their end-users are, and how they affect the organization. The area of end-user computing needs to be well defined by all organizations to determine how they will serve their end-users. If an organization cannot meet the demands of their end-users, that organization will not only be operating improperly, it may also be going out of business. Organizations need to determine who their end-users are, and how they will serve them.

Information Resource Management and End-User Computing do indeed impact each other. Further research is necessary to determine what the actual impact is, but the initial data does show that there is a connection between end-user computing and Information Resource Management. The two will grow more important in the next few

years, and once management can define their end-users and implement IRM policies, they can determine how the two affect each other.

Appendix

I. Information Resource Management

There seems to be a trend that would imply information is becoming one of the most valuable assets a firm possesses. The availability of, and trust we have in the firm's information is a critical component of the organization's functioning. This requires a maintenance/management function which includes the planning, direction and controlling of the information resource.

This management function is often referred to as Information Resource Management (IRM). IRM is, or should be, contrasted to information systems management, which is concerned primarily with the processing, transportation and communication of the information resource.

IRM is responsible for the availability, integrity, accuracy, validity and security of information. These responsibilities are associated with the protection of the information resource from both an internal and external perspective. The basic philosophy of Information Resource Management is the providing of information to anyone who has the need and the authority to use that information.

IRM is truly a philosophy for management; the management of information as a critical resource to the corporation. As such, management should be aware of IRM concepts and be willing to give effort that would support them.

1. How well does this scenario describe your firm?

1 - - - - 2 - - - - 3 - - - - 4 - - - - 5
Very well somewhat Not at all

Comments:

2. Has there been a recent change or do you intend to change the direction of the managing the resource called "information"?

1 - - - - 2 - - - - 3 - - - - 4 - - - - 5
Strong Change Some No Change

Comments:

3. In your firm, who is (or should be) responsible for implementation of such a corporate philosophy?

_____ Corporate Mgmt.
_____ Divisional Mgmt.
_____ Information Systems Mgmt.
_____ Information Systems Staff
Other (please list) _____

Comments:

4. How important do you feel Information Resource Management will become in the next decade?

1 - - - - 2 - - - - 3 - - - - 4 - - - - 5
Very Important Neutral Not Important At All

Comments:

II. End Users

An End User in an organization is anyone who uses or is affected by the information of the organization. End Users may include customer service and staff employees, supervisors, middle management, administrators, and customers. End Users are those who need information to do their jobs.

End Users have become a more important ingredient within the information system process due to use of intelligent workstations and the realization that information is important to anyone involved in the business process.

End Users are not centralized within an organization but are dispersed throughout it. In addition to employees, we now have customers who interface with the business process. Customers are now End Users, too.

1. To what extent is your firm committed to serving the End User?

1 - - - - - 2 - - - - 3 - - - - 4 - - - - - 5
Very Committed somewhat Not at all

Comments:

2. Who is primarily responsible for the involvement of the End User?

_____ Corporate Mgmt.
_____ Divisional Mgmt.
_____ Information Systems Mgmt.
_____ Information Systems Staff
Other (please list) _____

Comments:

3. Do you see End Users acquiring and using information as a growing phenomena in the next decade?

1 - - - - 2 - - - - - 3 - - - - - 4 - - - - 5
Very Much So somewhat Not at all

Comments:

4. What is the role of the End User himself/herself in your corporate strategic planning process?

1 - - - - - 2 - - - - 3 - - - - 4 - - - - - 5
Very Involved somewhat Not at all

Comments:

5. Is one class of End User more important than the others? If yes, which one?

YES NO

_____ Executive Management
_____ All Management
_____ Customers
_____ Support Staff
_____ General Staff

Comments:

III. End Users and Information Resource Management

End users and information resource management can work together and supplement each other. With both aspects emerging quickly in information trends today they can be viewed as working together to enhance the information capabilities of a firm.

End users must have the ability to impact information resource management. End users are the most knowledgeable about their own information needs and therefore should have a tremendous affect on the manner in which the information resource is managed.

Information Resource Management also has a large impact on the end user. IRM can improve the end users ability to process information by providing guidelines and standards that will direct proper use of the information resource. This will provide the end user with the correct information where and when they need it, in the form it is needed, while also protecting and securing the information resource.

1. Do you feel that the end user will have a stronger impact on IRM or do you feel IRM will affect the end user greater.

1 - - - - 2 - - - - - 3 - - - - - 4 - - - - 5
IRM Most Important End User Most Important

Comments:

2. Can end users effectiveness be optimized without well managed corporate information?

1 - - - - 2 - - - - - 3 - - - - - 4 - - - - 5
Definitely somewhat Not at all

Comments:

3. Will the end user shape corporate IRM policy during the next decade?

1 - - - - 2 - - - - - 3 - - - - - 4 - - - - 5
Definitely somewhat Not at all

Comments:

4. Who should be responsible for directing and integrating the information resources and the end users?

_____ Corporate Mgmt.
_____ Divisional Mgmt.
_____ Information Systems Mgmt.
_____ Information Systems Staff
Other (please list) _____

Comments:

5. Should one class of users (management, executives, customers, staff) have a stronger impact on the information resources than others?

YES NO

Which One:
_____ Executive Management
_____ All Management
_____ Customers
_____ Support Staff
_____ General Staff

Comments:

References

1. Jim Comes & Tom Harris. "Developing and Implementing An Information Resource Management Philosophy." Unpublished Working Paper. pp. 1-18. 1991.

2. Milt Bryce & Tim Bryce. The IRM Revolution: Blueprint for the 21st Century. (Palm Harbor, Florida: M. Bryce & Associates, Inc. 1988)

3. Richard H. Lytle. "Information Resource Management: 1981-1986. Annual Review of Information Science and Technology. Volume 21, 1986. pp. 309-335.

4. "Entity Relationship Modeling." The Computer Conference Newsletter. September 10, 1990. pp 1-8.

5. David R. Lee. "Changing Responsibilities: For Audit and Security of Information Resources." Information Executive. Spring 1990. pp. 13-19.

6. Peter F. Drucker. "The Coming of the New Organization." Harvard Business Review. January-February 1988. pp. 45-53.

7. Thomas R. Davies. "Managing the Stages of Information Resource Management Implementation." Information Management Review. Winter 1987. pp. 43-54.

8. Robert E. Umbaugh. "ISM Interviews...Peter F. Drucker." Journal of Information Systems Management. Winter 1987. pp. 91-96.

9. Clinton Wilder. "No A's for B-Schools." Computerworld. July 2, 1990. p. 51.

10. Alan J. Ryan. "Movers, Shakers, Pressure Makers: for Many, IS Life in the '90s is Exciting but Brings Extra Stress." Computerworld. November 12, 1990. pp. 113-115.

11. Ernest M. von Simson. "The 'Centrally Decentralized' IS Organization." Harvard Business Review. July-August 1990. pp. 158-162.

12. Jeffrey Schwartz. "FTS 2000 User Group." CommunicationsWeek. September 3, 1990. p. 6.

13. Forest W. Horton, Jr. Information Resource Management: Concept and Cases. (Cleveland, Ohio: Association for Systems Management. 1979)

14. John Maher. "Cross Platform Software Solutions Ease Data Centre's Load." Computing Canada. January 3, 1991. p. 11.

15. Glen L. Boyer. "Ten Facts of End-User Computing for Every Systems Manager." Journal of Systems Management. June 1990. v. 41. p. 14.

16. William W. Cotterman & Kuldeep Kumar. "User Cube: a Taxonomy of End-Users." Communications of the ACM. November 1989. v. 32. p. 1313 (8).

17. Kenneth G. Banks. "Networking 1990s Style: the Client must be Served." Systems Integration. October 1990. p. 37.

18. William E. Perry. "Recognizing that "End-Users' are Customers." Government Computer News. April 2, 1990. p. 50.

19. Grant Buckler. "Micro Managers and the Selection Process; Depending on Organization, Buyer Procedures Vary." Computing Canada. November 8, 1990. p. 42.

20. Francois Bergeron; Suzanne Rivard; Lyne De Serre. "Investigating the Support Role of the Information Center." MIS Quarterly. September 1990. p. 246 (15).

21. Will McClatchy. "The End User Gets Wiser at Some Shops, MIS now Dispenses Advice, Not Orders. Information Week. September 3, 1990. p. 32 (2).

22. George Hefferon. "A Two Way Street." Information Executive. Fall 1990. p. 27 (3).

23. Jenifer Wagner. "What is End-User Computing?" Information Executive. Fall 1990. p. 24-27.

24. Kathleen O'Shea & Krishnamurty Muralidhar. "The Function and Management of Information Centers. Journal of Systems Management. December 1990. p. 7-10.

25. Altman, Ross, "Are You Ready for Cooperative Processing?" Information Center, April 1990, pp. 20-31.

26. Carr, Houston H., Managing End User Computing, (Edgewood Cliffs, N.J.: Prentice Hall, Inc., 1988).

27. Greenburg, Eric R., "The Rise of the End Users", Management Review, September 1989, p. 57.

28. Owen, Darrell E. "IRM Concepts: Building Blocks for the 1990s." Information Mangement Review, Fall 1989, pp. 19-27.

29. Owen, Darrell E. "Building a Customer-Driven IRM Program", Chief Information Officer Journal, Summer 1990, p. 39.